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BEFORE THE

Federal Communications Commission

WASHINGTON, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of	)	
	)	
Amendment of Part 2 of the Commission's Rules to Allocate the 455-456 MHz and 459-460 MHz Bands to the Mobile-Satellite Service	)	**ET Docket No. 97-214**

To: The Commission

COMMENTS OF THE AMERICAN PETROLEUM INSTITUTE

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Dated: December 1, 1997

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SUMMARY

API strongly objects to the Commission's proposal to permit Little LEOs to operate in the band 459-460 MHz. Included within this band is a 25 kHz channel (459.000 MHz) dedicated to oil spill containment and clean up communications. Oil spill response and clean up operations are emergency activities which require reliable and efficient communications support. As a result, any interference to operations on the 459.000 MHz oil spill channel could result in unwarranted damage to life, property and/or the environment.

The international allocation of the band 459-460 MHz was based upon a seriously flawed engineering analysis which does not account for the actual manner in which this band is used by incumbent licensees. A more accurate study conducted by the Land Mobile Communications Council demonstrates that the potential for sharing in the 450-460 MHz band by Little LEO and land mobile licensees would be virtually impossible. Accordingly, the Commission should not proceed with the domestic allocation of the 459-460 MHz band for Little LEO services. At a bare minimum, the Commission should: (1) exclude the oil spill channel at 459.000 MHz and the 25 kHz channel that is adjacent to it from the Little LEO allocation; and (2) adopt the proposed footnotes to its Table of Allocations which essentially make Little LEO licensees secondary to land mobile operations in the band 459-460 MHz.

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COMMENTS OF THE AMERICAN PETROLEUM INSTITUTE

The American Petroleum Institute ("API"), by its attorneys and pursuant to Section 1.415 of the Rules and Regulations of the Federal Communications Commission ("Commission"), hereby respectfully submits these Comments concerning the Notice of Proposed Rule Making ("Notice") released by the Commission on October 14, 1997 in the above-captioned proceeding.[1/]

I. PRELIMINARY STATEMENT

1. API is a national trade association representing approximately 300 companies involved in all phases of the petroleum and natural gas industries, including

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[1/] 62 Fed. Reg. 58,932 (Oct. 31, 1997).

exploration, production, refining, marketing, and transportation of petroleum, petroleum products and natural gas. Among its many activities, API acts on behalf of its members as spokesperson before federal and state regulatory agencies. The API Telecommunications Committee is one of the standing committees of the organization's Information Systems Committee. One of the Telecommunications Committee's primary functions is to evaluate and develop responses to federal and state proposals affecting telecommunications services and facilities used in the oil and gas industries. Consistent with that mission, it also reviews and comments, where permitted, on other proposals that impinge on the ability of the energy industries to meet their telecommunications needs.

2. API members are involved in every aspect of the petroleum and natural gas business, overseeing the recovery, refining and transport of petroleum, petroleum products and natural gas. These energy sources are transported through pipelines, over rail, highways, sea lanes and inland waterways. In the event of an emergency at a refinery, drilling site or during transport, the petroleum industry and oil spill clean up contractors rely upon the use of the oil spill response frequency assignments to direct emergency containment and clean up programs. Timely and efficient responses are essential to successful recovery efforts, where delay or confusion can lead to disastrous results and unwarranted additional damage to life, property and the environment.

3. In its prior proceeding in IB Docket No. 96-220, the Commission proposed to allocate, among other spectrum, a service uplink in the 459-460 MHz band for the second processing round of non-voice, non-geostationary mobile-satellite systems ("NVNG MSS" or "Little LEOs"). Within this band is a 25 kHz channel centered at 459.000 MHz that is specifically dedicated for communications related to oil spill containment and clean up activities. The Commission's proposal anticipated the domestic implementation of an allocation made at the World Radiocommunications Conference 1995 ("WRC-95") which designated spectrum at 459-460 MHz and other bands for Little LEOs.[2/] API, several individual members of the oil industry and a number of organizations involved in oil spill prevention, containment and clean-up efforts filed Comments in IB Docket No. 96-220 which vigorously opposed the Commission's proposal for the 459-460 MHz band.[3/]

4. The Commission released a Report and Order in IB Docket No. 96-220 on October 15, 1997 which sets forth rules and policies for the licensing and operation of Little LEOs in the second processing round. While the sharing plan for second round

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[2/] At WRC-95, the 399.900-400.050 MHz uplink band was allocated for Little LEO use worldwide, and the 455.000-456.000 MHz and 459.000-460.000 MHz uplink bands were allocated for use in Region 2.

[3/] See, e.g., IB Docket No. 96-220 Comments of: Garner Environmental Services, Inc.; Texas General Land Office; Clean Channel Association; Cook Inlet Spill Prevention & Response Inc.; Clean Caribbean Cooperative; Clean Sound Cooperative, Inc.; Texaco; and U.S. Oil & Refining Co.

Little LEO licensees does not involve the WRC-95 uplink spectrum at 459-460 MHz, the Commission has initiated the instant rule making proceeding to implement the domestic allocation of this spectrum for Little LEO services. Accordingly, the Commission indicated in its Report and Order that the concerns expressed in the Comments of the petroleum and oil spill clean-up industries should be addressed in this new proceeding. (Report and Order, IB Docket No. 96-220, at ¶ 23).

II. COMMENTS

5. In its Notice, the Commission seeks comment on its proposal to allocate the 455-456 MHz and 459-460 MHz bands for use on a co-primary basis by Little LEO systems. (Notice at ¶ 11). In identifying current uses of these bands, the Commission acknowledges that "[a] single channel at 459.00 MHz is reserved for oil spill containment and cleanup operations and for training and drills essential in the preparations for the containment and cleanup of oil spills." (Notice at n.11). Noting that petroleum industry operations at 459 MHz "may be used only intermittently but require a high degree of reliability," the Commission seeks comment on whether using the 459-460 MHz band for Little LEO operations would be compatible with current and future fixed and mobile operations. (Notice at ¶ 13). The Commission also asks "whether certain portions of this band should not be allocated for Little LEO operations." (Id.) (emphasis added). For the reasons set forth below, API strongly urges the Commission not to move forward with the

allocation of the 459-460 MHz band for Little LEO services or, at the very least, to exclude the 25 kHz oil spill channel from this allocation.

A. Effective Communications Are Essential to Oil Spill Response and Clean Up Operations

6. As noted above, the 459-460 MHz band contains a 25 kHz channel at 459.000 MHz which is allocated to petroleum industry licensees and dedicated on a primary basis for communications related to oil spill containment and clean up activities. 47 C.F.R. § 90.35(c)(8). Thus, the ability of the petroleum industry and clean-up contractors to properly support oil spill containment and clean-up operations could be negatively impacted by adoption of the Commission's proposal.

7. Section 90.35(c)(8) of the Commission's Rules provides for the secondary use of the 459.000 MHz channel for general base-mobile operations on a noninterference basis. 47 C.F.R. § 90.35(c)(8). These operations may occur only when the channel is not

required for oil spill containment and clean-up operations.[4] Accordingly, licensees employing this channel for regular operations are required to clear the frequency immediately in the event of an oil-related emergency. See 47 C.F.R. § 2.106, n.NG 112.

8. The oil spill containment and clean up operations, as well as the training and drills supported by the 459.000 MHz allocation, are vital to the protection of public safety, the environment, and workers in the petroleum industry. In order for an oil spill response and clean up operation to be effective, activities must be immediately coordinated among onshore operators, ships at sea, aircraft, various government officials, and containment and clean up personnel. Without access to the type of communications available using UHF radios that employ the 459.000 MHz channel, however, such coordination would be nearly impossible.

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[4] Specifically, Section 90.35(c)(8) of the Commission's Rules and Regulations provides that the frequency 459.000 MHz:

> is primarily available for oil spill containment and clean up operations and for training and drills essential in the preparations for the containment and clean up of oil spills. It is secondarily available for general base-mobile operations on a noninterference basis. Secondary users of this frequency are required to forego its use should oil spill containment and clean up activities be present in their area of operation or upon notice by the Commission or a primary user that harmful interference is being caused to oil spill containment or clean up activities in other areas.

47 C.F.R. ¶ 90.35(c)(8).

9. Moreover, there are three factors which affect the severity of a marine oil spill incident: weather conditions, tidal direction, and swiftness of response. The only factor which can be altered through human intervention is the rapidity of the response. Effective communications are the key to rapid initiation of oil spill containment and clean up operations. Clearly, the communications capability which is currently provided by use of the oil spill response and clean up channel serves the public interest. API does not believe that reallocation of the spectrum to commercial satellite interests, such as Little LEOs, for their profit-making purposes engenders the same level of public benefits.

B. Spectrum Sharing Between Little LEO Licensees and Land Mobile Operations is Not Feasible

10. The Commission states that, although preliminary sharing analyses and spectrum utilization studies conducted in conjunction with WRC-95 indicated that the 455-456 MHz and 459-460 MHz bands may have potential capacity for sharing with Little LEO uplinks without creating an unacceptable impact on incumbent operations, further study was considered necessary. (Notice at ¶ 14). Further, the Commission acknowledges that the report on frequency sharing prepared since WRC-95 by Informal Working Group 2A ("IWG-2A") "did not specifically focus on the 455-456 MHz and 459-460 MHz segments." (Notice at ¶ 15). Accordingly, the Commission has asked whether there is sufficient sharing capacity in these bands to support the proposed Little

LEO allocation and whether there are techniques available that would permit Little LEOs to share this spectrum without causing harmful interference to or constraining the development of incumbent operations.

11. In connection with IWG-2A, the Land Mobile Communications Council ("LMCC") presented a paper entitled "Preliminary Study of Sharing Between Non-GSO MSS Below 1 GHz and Terrestrial Private Land Mobile Systems" (hereinafter "LMCC Study").[5/] Focusing on the 450-460 MHz, 790-862 MHz and 890-902 MHz bands, the LMCC Study demonstrates that sharing in these bands by Little LEO and land mobile licensees would be virtually impossible. Specifically, the LMCC Study concludes that:

> [I]t is apparent that significant problems exist with NVNG systems sharing existing domestic terrestrial land mobile allocations without significant probability of harmful interference. Satellite scanning receiver interference avoidance approaches will be compromised by doppler effects and time delays. When realistic assumptions are made, NVNG use of the land mobile bands would result in substantial interference to land mobile systems operating therein.

LMCC Study at 18, (emphasis added). The Study also describes the serious flaws upon which seemingly conflicting studies prepared by Little LEO proponents have been founded. (LMCC Study at 13-18). For example, Little LEO proponents erroneously

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[5/] A copy of the LMCC Study is attached hereto as Exhibit A.

have assumed low terrestrial land mobile receive antenna heights and have ignored the effects of squelch circuitry. (See LMCC Study at 14-16).

12. Indeed, the WRC-95 allocation of the 459-460 MHz band to the Little LEO service was, in itself, based on flawed analysis. In advocating such an allocation, the second round Little LEO applicants relied upon the results of a suspect engineering survey of the domestic, U.S. users of the 459-460 MHz band.[6/] As the attached Exhibits B and C indicate, API on numerous occasions attempted to illuminate the discrepancies in the Little LEOs' proposal. In particular, API pointed out in its Response to the Joint Comments of the second round Little LEO applicants in IC Docket No. 94-31 that the Little LEO consultants' Engineering Statement failed to adequately recognize that:

> [T]he 459.000 MHz channel exists for oil spill containment and clean up operations . . . . The Engineering Statement only notes that "it is reported" that the entire 459-460 MHz band does not enjoy active use and that scanner monitoring of the entire band during regular business hours in the Washington, D.C. area revealed 'very few transmissions within this band during the monitoring period.' Based on this scanty, and wholly inadequate assessment, the Engineering Statement concluded that the band experiences only low and intermittent usage levels and thus the entire band, including the 459.000 MHz channel, should be free for [Little LEOs].

(API Response at 5 (Exhibit B)).

[6/] That engineering statement was prepared for Little LEO interests by Cohen, Dippell and Everist, P.C.

13. Significantly, all of the operators of the 459.000 MHz channel are located in oil transport and production areas, **not Washington, D.C**. Thus, when the Little LEO consultants researched the traffic loads in the 459-460 MHz band in Washington, D.C. -- without even considering the purpose and uses of the band -- they made a fundamental error which could have far-reaching impact. API urges the Commission not to rely upon their analysis, but to consider the nature of the emergency communications conducted on this critical channel.

14. Because the 459.000 MHz channel must be kept clear for communications directly related to oil spill and containment operations, petroleum industry licensees purposely do not utilize the channel for heavy traffic loads in connection with their day-to-day operations, even though they may be authorized to do so on a secondary basis. In addition, training and drills essential in the preparation for containment and clean up operations do not occur every day; instead, they are conducted at regular intervals of several weeks or months. Thus, the analysis of the 459-460 MHz band which was performed for Little LEOs by a third party consultant -- and which formed the basis for their request for an international allocation -- did not adequately consider the purpose of the oil spill response and clean up channel. This oversight might simply be trivial were it not for the serious ramifications which could occur if the Commission is led to rely upon the errant engineering analysis provided by the Little LEO consultants. API believes that a close examination of all available evidence necessarily will lead to the conclusion that

sharing is infeasible and that the 459-460 MHz band should not be allocated to the Little LEO service.

C. At the Very Least, the Commission Should Exclude the Oil Spill Channel from the Contemplated Little LEO Allocation and Implement the Footnote Protections Adopted at WRC-95

15. The Commission has proposed to amend its Table of Frequency Allocations to include footnotes adopted at WRC-95 which would prevent Little LEO licensees from causing harmful interference to, claiming protection from, or constraining the development or use of the 455-456 MHz and 459-460 MHz bands by fixed or mobile service licensees. Thus, the Commission states in its Notice that, although the international allocation for Little LEO operations in these bands is on a co-primary basis with fixed and mobile services, Little LEO operations "are effectively secondary to fixed and mobile services." (Notice at ¶ 10).

16. While API agrees that the adoption of these footnotes may reduce the risk of disruption to oil spill response and clean-up operations on the channel centered at 459.000 MHz and, as a result, strongly supports the inclusion of these footnotes should the Commission move forward with this allocation, API nonetheless believes that the proposed allocation of the 459-460 MHz band to Little LEO operations should be abandoned. After all, the footnotes would not eliminate the risk that oil spill response

operations at 459.000 MHz will encounter interference from Little LEO operations up to and until the time that the source of the interference is identified, contacted and requested to cease its interfering operations. Given the technical and practical barriers to spectrum sharing described above, it is likely that the actual occurrence of this type of interference situation would not be uncommon. In an oil spill emergency, even one unauthorized user can wreak havoc. The frequency, therefore, should not be shared.

17. Due to the infeasibility of sharing throughout the 459-460 MHz band, API believes that no portion of this spectrum should be allocated for Little LEO use. Such an outcome would be entirely consistent with the Commission's prior representations to the second round Little LEO licensees, as the Commission specifically has instructed them "to develop business plans that will accommodate the operation of their system [sic] in the spectrum they are authorized to use in the first and second processing rounds without any expectation of obtaining additional spectrum." (Report and Order, IB Docket No. 96-220, at ¶ 134) (emphasis added).

18. If, however, the Commission is unwilling to abandon its proposal with respect to the entire 459-460 MHz band, it should at least exclude the 25 kHz oil spill channel at 459.000 MHz and the channel that is adjacent to it from the Little LEO allocation such that the allocation would commence at 459.050 MHz, rather than at 459.000 MHz. This approach would avoid interference with the oil spill channel, thereby

eliminating the risk that Little LEO systems will disrupt critical oil spill clean up operations, while at the same time preserving .950 MHz of the contemplated 1 MHz allocation for potential use by Little LEO systems.

III. CONCLUSION

19. The petroleum industry relies upon the 459.000 MHz channel today and every day to ensure immediate access for emergency communications. Oil spill and containment operations can occur practically anywhere and at anytime throughout the nation. These incidents are not limited to coastal areas. They can occur on inland waterways from barges or pipeline ruptures or on land from, for example, tank farms or pipeline leaks. All credible evidence indicates that Little LEOs cannot feasibly share the 459-460 MHz band -- including the oil spill response channel at 459.000 MHz -- with land mobile licensees. Because the public interest would not be served by denying oil spill and containment coverage to the people and property affected by important spill and containment operations, the Commission should refrain from allocating the oil spill channel centered at 459.000 MHz to Little LEOs.

WHEREFORE, THE PREMISES CONSIDERED, the American Petroleum

Institute respectfully urges the Federal Communications Commission to act in a manner fully consistent with the views expressed herein.

Respectfully submitted,

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Dated: December 1, 1997

EXHIBIT A

IWG-2A/57
30 July 1996

Submitted by: LMCC[1]

Preliminary Study of Sharing Between Non-GSO MSS Below 1 GHz and Terrestrial Private Land Mobile Systems

This paper analyzes the sharing of spectrum between NVNG MSS systems and private land mobile systems (PLMRS). It takes as its basis the sharing studies performed by NVNG proponents prior to WRC-95 and a study currently before Working Party 8D (*see* 8D/36). This paper assumes that NVNG systems would attempt to share with terrestrial allocations solely for MSS uplinks, as NVNG proponents apparently have concluded that sharing between terrestrial land mobile and MSS downlinks is not feasible. *See* IWG-2A/40 (Rev. 1).

I. Background

When WRC-92 allocated global spectrum near 140 MHz and 400 MHz for mobile satellite systems (MSS), the U.S. administration had already licensed several operators at those frequencies. In preparation for WRC-95, proponents of non-GSO MSS below 1 GHz (also known as NVNG MSS) sought to expand that allocation by "7-10 MHz" to account for demand growth and follow-on systems.

Several of the candidate bands proposed by the U.S. at that time were allocated for land mobile services. Those bands are heavily used in the United States and abroad by terrestrial land mobile (voice and data) systems. During the U.S. preparatory process, members of the terrestrial land mobile community shared information with NVNG proponents on the characteristics of terrestrial systems, and the mechanisms of sharing. In particular, terrestrial land mobile licensees, associations and manufacturers discussed sharing with NVNG systems utilizing FDMA or CDMA formats.

Although NVNG services received some additional global allocations at WRC-95, the service proponents are again seeking "10-20 MHz" of additional spectrum for WRC-97. *See* IWG-2A/39 (Rev. 1); IWG-2A/9 (Rev 1). NVNG proponents are considering sharing spectrum allocated to land mobile services and used in the United States for terrestrial land mobile systems, in particular, the band 450 to 460 MHz. Additional land mobile allocations near 800 MHz are also identified as "candidate bands" for shared use by NVNG systems.

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[1] The Land Mobile Communications Council ("LMCC") is a non-profit association of organizations representing users of land mobile radio and providers of land mobile services and equipment. A list depicting LMCC's membership is attached at the end of this document.

In support of this plan, NVNG proponents are drafting sharing studies that purport to make a case for sharing of spectrum allocated to terrestrial land mobile. Earlier this year, a preliminary study was transmitted to Working Party 8D (*see* 8D/36), over the reservations of Motorola that the underlying assumptions of the study need to be examined.

II. Terrestrial Systems, Licenses and Characteristics

The NVNG MSS proponents have identified the following frequency bands, allocated in the U.S. for mobile service, as potential sharing candidates: 450-460 MHz, 790-862 MHz and 890-902 MHz.[2] In the U.S., each of these bands have numerous exclusive sub-allocations for specific terrestrial applications. For example, the 450-460 MHz band is sub-allocated to traditional land mobile dispatch, broadcast auxiliary services, air-to-ground systems, and mobile telephone operations. This paper will focus on the effects of NVNG MSS sharing with the private land mobile radio services (PLMRS) as regulated by Part 90 of the FCC's Rules. *See* Title 47 C.F.R. Part 90. A further description of each band is detailed below.

450-460 MHz Band: The PLMRS allocations in this band occupy 451-454 MHz and 456-459 MHz. These two bands are paired to allow for repeater operations. The lower band, 451-454 MHz, is used as the transmitting frequency for high power, fixed repeater transmitters. The upper band, 456-459 MHz, is used as the transmitting frequency for the low power mobile and portable units.

These frequencies are used solely by public safety and critical industries such as utilities, petroleum companies, manufacturers, telephone maintenance, forest-related industries, local government, railroads, airlines, and highway maintenance. Systems range from wide area public safety networks covering state-wide service areas to low power, on-site communications for manufacturing plants. Both voice and data systems occupy the bands. FM technology (20k0F3E) are typical but digital and TDMA operations are now being introduced into the band. Nationwide, channels assignments are made every 12.5 kHz. While 25 kHz technology is now standard, 12.5 kHz and 6.25 kHz wide technologies are expected to be more common over the next 10 years.

Available for over 40 years, the 450 MHz PLMRS bands are perhaps the most intensely used frequency bands regulated by the FCC. Although precise numbers for the band are not available, in 1995 the FCC indicated that over 12 million transmitting devices were authorized in the "refarming bands" at 150 MHz, 450 MHz, and 470-512 MHz and that the total user investment in equipment in

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[2] The other primary private land mobile allocation exists near 150 MHz. The NVNG MSS industry has not identified that specific band as a candidate sharing possibility so it is not discussed here.

these bands exceeds 25 billion dollars.[3] The 450 MHz band is the largest of these three bands and its share well exceeds 33 percent of these totals.

790-862 MHz Band: This candidate band overlaps U.S. allocations made to the private land mobile radio services in the frequency bands 806-824 MHz and 851-869 MHz. For terrestrial use, these bands are paired to allow for repeater operations. The lower band, 806-824 MHz, is used as the transmitting frequency for the low power, mobile and portable transmitting devices. The upper band, 851-869 MHz, is used as the transmitting frequency for the high powered, fixed repeater transmitters. This orientation is reversed from the 450 MHz band.

There are multiple sub-allocations within the 800 MHz private land mobile band. The 806-821/851-866 MHz portions have been allocated since the mid-1970's for both single channel conventional systems and multi-channel trunked radio systems. Channels are spaced every 25 kHz apart yielding a total of 600 channel pairs.[4] Of these, 70 channels are available for public safety users, 100 channels are available for business and industrial users, and 430 channels are available for commercial, specialized mobile radio (SMR) operations. The FCC recently concluded that all future licensing on the 430 SMR channels will proceed via competitive bidding or auctions. (Portions of that decision are still being contested by some LMCC members.)

The 821-824/866-869 MHz band is allocated for the exclusive use of public safety agencies. While the technical and operational characteristics are similar to those utilized in the other portions of the 800 MHz band, *i.e.*, both conventional and trunked systems are authorized, channels are spaced every 12.5 kHz. Adjacent channel coordination is thus required.

The 800 MHz private land mobile bands contain over 6 million transmitters.[5] Total licensee investment in equipment is estimated to well exceed 10 billion dollars.

890-902 MHz Band: The mobile transmit side of the "900 MHz" PLMRS allocation occupies the 896-901 MHz band. Available to SMRs, business and industrial users, channels are spaced every 12.5 kHz. Equipment is "narrowband" and limited to 13.6 kHz authorized bandwidth. The sub-allocation for SMR service is interspersed with the allocations for business and industrial operations. Recently, the FCC auctioned the 900 MHz SMR channels (without

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3 Report and Order and Further Notice of Proposed Rule Making, PR Docket No. 92-235, released June 23, 1995.

4 Within 70 miles of the U.S./Mexican border, channels are assigned every 12.5 kHz to facilitate international shared use of the bands. This particularly affects spectrum availability in the southern California area.

5 FCC Annual Report, FY 1994.

displacing the incumbents) and raised over 200 million dollars.[6] It is unlikely that these auction winners contemplated that they were buying spectrum that contained a future requirement for shared access with a competitive service provider.

III. NVNG System Characteristics

For TDMA NVNG systems, this paper utilizes the characteristics described in 8D/36.

IV. Interference Criteria

As currently described, NVNG MSS MES[7] transmissions will be of short duration and low duty cycle. Thus, it is appropriate to define satellite to land mobile interference criteria on the basis of periodic communications service interruption rather than some "average" interference level as might be experienced from a more continuous operating device.

The significance of the nature of the interference during interruption can be understood, for example, by considering the difference between a one second white noise sound, a loud 1 kHz whistle, and a quiet period of conversational interruption i.e. a "mute". It is probable (for land mobile) that the white noise burst is preferable to the muted condition which is still preferable to a sharp, painful whistle. On the other hand, the duration of the interruption bears on this effect as, for example again, one cannot even achieve the perception of a "whistle" if the duration is short enough. This analysis presumes that the duration of individual service interruptions will be in the milli-second region and divides such incidents into "clicks" or "blips" or short mutes. Clicks would be deemed to be of duration 0-25 milliseconds., "blips" of duration 25-200 milliseconds. and "mutes" to be greater than 200 milliseconds.[8]

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6 While not specifically addressed in this paper, this band also contains an allocation at 901-902 MHz for narrowband PCS devices.

7 Mobile Earth Stations. Such stations might be vehicular mounted or portable or fixed in place.

8 Perception of the interference event(s) may be by a single person, either a mobile operator or dispatcher, or by a simultaneous group of persons in the case of interference to a repeater (i.e. the interference event gets communicated to all the listeners in the group). But in any case, interference is a single listener perception issue. Of the two types of listener, the dispatcher will generally be the most sensitive to interference as (1) his/her main job is the continuous interfacing to the radio channel and (b) the dispatcher operating environment is generally much quieter than that of the mobile operator (with dispatcher often wearing headphones to reduce background noise).

The LMCC believes that the maximum acceptable duration for an MSS interference event should be no greater than 125 milliseconds. As further described below, such an interfering signal would be lengthened approximately another 100 milliseconds due to squelch circuits in the land mobile receiver. Service disruptions of approximately 225 milliseconds are sufficient to eliminate at least one syllable of a word and would cause substantial degradation to a land mobile data stream.

The nature of these disruptions must be considered when predicting the permissible periodicity of MSS interference events so that the service levels of land mobile stations are not degraded to unacceptable levels. For example, it has been stated that the an appropriate level of service degradation is 0.1 percent. This is based on a number of premises, one of which is that 99% operating availability is generally the maximum land mobile system design requirement, particularly for public safety and other mission critical services, and that a degradation from a 99 percent availability to 98.9 percent would be acceptable.

From the above, interruption due to an interference event can be generalized to be of duration D= (t+0.1) seconds where t is the duration of the MSS interfering transmission and 0.1 represents the effects of the squelch circuitry. To limit land mobile service availability degradation to 0.1 percent, the allowable repeat period for interference events would be T=1000(t+0.1) seconds. For example, an interfering blip of 100 milliseconds would require a minimum repeat time period of 200 seconds.

This analysis is complicated by the proposal that multiple LEO service providers seek to operate in the same bands and each present their own interference potential. It should be noted that this periodicity requirement would have to be maintained for simultaneous multiple LEO service providers operating in the area of the interference victim. Considering that each of the multiple proposed NVNG MSS service providers (8 to 10 at this time) would not be knowledgeable of their competitors deployments, then one should generally set the maximum duty cycle, *i.e.*, degradation of land mobile service availability, at (0.1/N) percent. Since it is unlikely that all MSS systems will be contributing equally to the victim's LEO interference condition, it could be appropriate to assume N (the number of contributing MSS systems) to be 3 (this is believed to be consistent with the practices in microwave services). Thus, the maximum duty cycle for any one service provider becomes (0.1/3) percent or 0.0333 percent.

V. General Sharing Considerations

This section discusses the broad issues surrounding the proposals of the MSS proponents to share land mobile spectrum by using "underutilized" or "vacant" spectrum slots.

A. Land Mobile Spectrum Use

In the first instance, NVNG MSS proponents state they will transmit from satellite mobile terminals to the satellite only after determining (at the satellite) that a channel is not in use. However, at least in North America, the heavy occupancy and use of the terrestrial private land mobile bands in the 150 MHz, 450 MHz and 800 MHz bands will result in few vacant channels.

Empirical studies have shown that typical land mobile voice communications average 4 transmissions (with breaks between) totaling 15 seconds. Each unit makes one transmission, on average, every two hours. A typical footprint of a MSS system is more than 3000 kilometers in diameter. If aimed directly at the center of the U.S., the beam would cover the entirety of North America. Because NVNG MSS systems determine channel availability at the satellite, the footprint size is relevant to the uplink channel selection—it becomes the field of view for determining terrestrial mobile channel vacancy.

In the PLMRS frequency bands at 150 MHz and 450 MHz—where users are required to share channels and lack channel exclusivity—there is an average of nearly 10,000 (9,688) licensed transmitters per channel in the US. This makes it highly unlikely that one transmitter is not using the channel somewhere in the footprint of the MSS at all times.

Even on lightly loaded channels, simultaneous "quiet" periods when all transmitters cease operating are highly unlikely. Statistical data has been developed that shows that on Business Radio Service channels, there is unlikely to be a time during the business day (7 am Eastern and 7 pm Pacific) in the Continental United States ("CONUS") when a given channel is vacant throughout the nation. (Hess study, 1979).

Assuming the business radio channels studied by Hess are typical, aggregating those figures across the entire United States gives the following probability figures:

Percent Likelihood	# of Simultaneously Operating Co-channel Transmitters
50%	36.5
0.13%	<22
0.00003%	<11

Thus, there is a 50 percent probability, that at any given time, there are more than 36 transmitters operating on any given frequency in the United States. The probability that there would be no transmitters operating on any given frequency is so small it is effectively zero. Thus, it would appear difficult, if not impossible, for NVNG MSS systems to find unoccupied spectrum in terrestrial land mobile allocations.

B. Time Delay

If the satellite mistakenly determines that a channel is open and permits a satellite mobile earth station to transmit, the transmission may be blocked by interference from the land mobile transmission. In that case, under this sharing scheme (essentially, an ALOHA contention protocol), the satellite earth station will seek another channel and make additional transmissions trying to get through. This will further reduce the throughput of the NVNG MSS systems, and could create additional interference to terrestrial land mobile systems.

The foregoing will be made worse by satellite propagation and processing delay. Of course, having determined that a channel is open, a second later it could be occupied by a land mobile transmission, which then blocks the satellite mobile earth station signal. The magnitude, and effect, of time delay issues is detailed below. It is worth noting, however, that NVNG proponents concede that this is a problem - the Final Analysis FCC application reveals that it takes over 1 second to determine channel availability.

The time delay of interest is illustrated in Figure 1. The satellite samples the candidate channels for a period of time, T_1 with its spectrum analyzer, then processes that data for a time T_2. Channel N has been determined unused, so the spacecraft codes that information along with the other channels that have been determined unused, and transmits it for a period of T_3. The signal travels to the earth for a period T_4, and proceeds through the selective filters of the MES ground unit for a period T_5. That ground unit chooses channel N on which to make its transmission, and randomly selects one of the five 100 ms time slots in the next 500 ms period to transmit in; it takes a time period of T_6 to make this choice. On average, it will choose the time slot number three which is the center slot, and it takes a time, T_7 to wait for this slot to arrive. The MSS ground unit transmits its signal in the 100 ms time slot, T_8 and it takes a time T_9 for the signal to arrive at the victim land mobile Receiver.

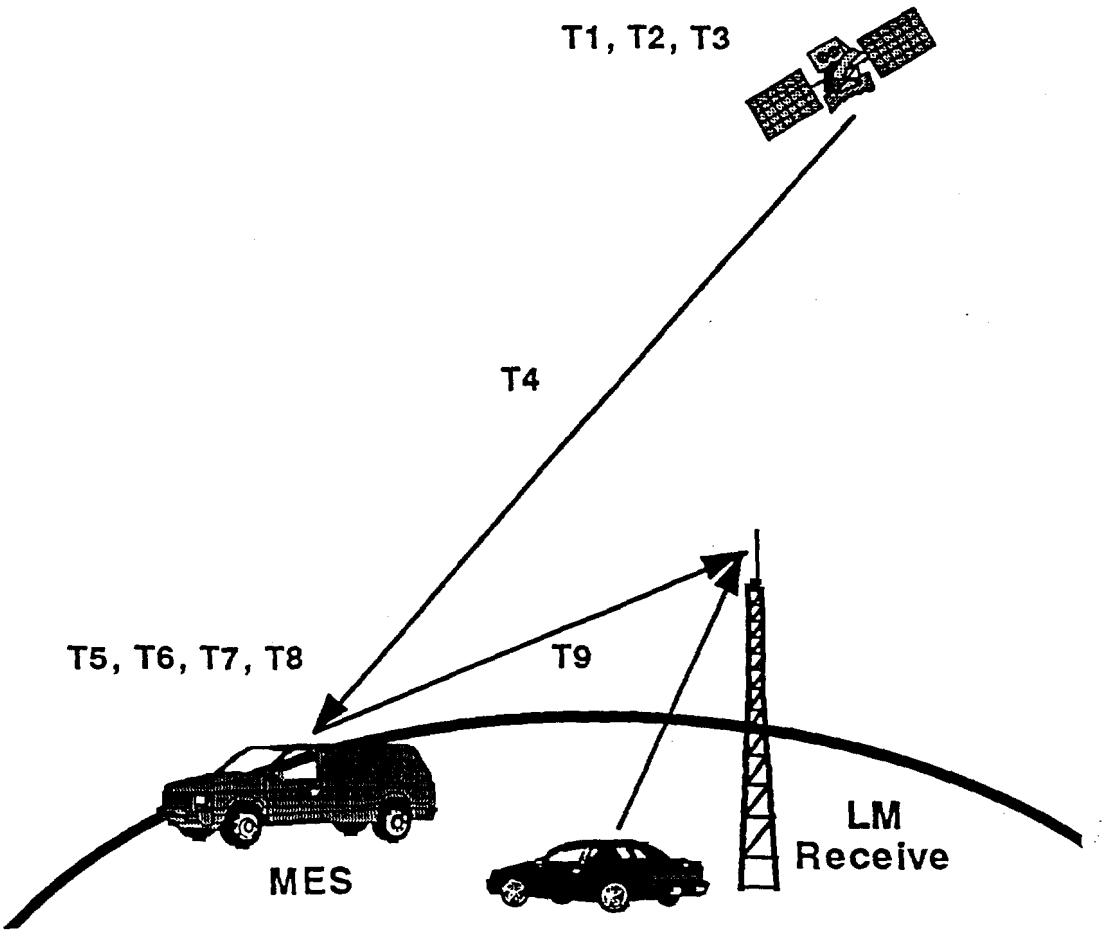

Figure 1: Satellite with ground based MSS and LAND MOBILE units

All of these times are estimated in Table 1. It is assumed that the land mobile transmitter just started transmitting after the satellite began to scan the channels, and that it was on a channel that was near the first to be scanned.[9] The total time delay from when the land mobile transmitter signal arrived at the victim receiver until the MES signal arrived there is about 850 ms, and the MES will continue to interfere for 100 ms of the land mobile transmission. In other words, the land mobile signal will be interrupted almost one second into the transmitted message. The impact of such an interruption could be devastating for critical messages on land mobile systems.

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9 It is assumed that the spectrum analyzer will be a scanning analog unit which starts at one end of the spectrum and proceeds to the other end. It is possible to use an analyzer that samples the whole desired fixed filtered bandwidth of candidate channels for a period of time, and then does a Fast Fourier Transform on the signal. However, there are limitations on the sampling speed that are imposed by the possibility of falling due to the high level TV channel 14 picture carrier that is adjacent to the land mobile band. Limitations are also imposed by the limitations on the resolution bandwidth that is desired and by the current drain of the DST that would be used.